I hereby certify that this correspondence (including Exhibits) is being deposited with the United States Postal Service via Express Mail in an envelope addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on August 15, 2006 **(Express Mail Label No.: ET615079096US)**.

Natu J. Patel

OIPE IAP80 AUG 15 2006 PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of C. Earl Woolfork :

Serial No. 10/648,012 : Group Art Unit: 2615

Confirm. No.: 3337 : Examiner: Andrew C. Flanders

Filed: August 26, 2003 :

For: WIRELESS DIGITAL AUDIO MUSIC SYSTEM

DECLARATION OF APPLICANT UNDER 35 USC Section 132

I, C. Earl Woolfork, being duly sworn, depose and declare as follows:

1. I am the Inventor of the above referenced patent application ("Application"). I have personal knowledge of the following matter and if asked to testify, could and would testify competently, thereto.

2. Daphne Burton, my then attorney, conducted the interview with Examiner Flanders and Supervisory Patent Examiner Tran (collectively "Examiners") on June 13, 2006 regarding the pending office action dated May 17, 2006 ("Office Action"). I participated in that interview.

3. During the interview, among other things, page 6 of the Office Action was discussed, which states that, "A frequency shift keying (FSK) modulation/detection technique could be used given a frequency hopping spread spectrum (FHSS) system choice. The terms and techniques discussed in this sentence (FSK and FHSS) were not present in the parent disclosure nor in the current application's disclosure and thus are new matter."

4. During the interview, I explained to the Examiners that that FSK is an inherent feature of FHSS and that FHSS and direct sequence spread spectrum ("DSSS") are two inherent features of CDMA. In response to the discussion, Examiners requested that I submit evidence through an affidavit under 35 USC Section 132 providing substantiation.

5. I am hereby submitting this affidavit together with the supporting documentation for consideration and respectfully requesting that the new matter rejection relating to this particular issue be withdrawn.

6. Paragraph 0016, lines 14 – 16 of the Parent Application 10/027,391, recites in part that, "This code division multiple access technique (CDMA) may be used to provide each user independent operation."

7. Relevant pages from the well known text book entitled, "Spread Spectrum Systems with Commercial Applications," by Robert C. Dixon, Third Edition, are attached herewith as Exhibit A. Here are the relevant excerpts from Exhibit A:

a. "CDMA, or code-division multiple access systems, use codes to separate one signal from another . . . . . Either direct sequence or frequency hopping systems can employ CDMA,..." (Refer to Page 2 of Exhibit A)

b. "For some reason which is not obvious, it is often assumed that CDMA and direct sequence methods are synonymous. Our discussion of CDMA in the previous section certainly applies to direct sequence (notice that the words "direct sequence" were never used) but also may be applied to frequency hopping." (Refer to Page 3 of Exhibit A)

c. "Frequency hopping modulation is more accurately termed multiple frequency, code selected, frequency shift keying. It is nothing more than FSK (frequency shift keying) except that the set of frequency choices is greatly expanded." (Refer to Page 4 of Exhibit A).

8. Based the above, it is apparent to one skilled in the art that FSK is an inherent feature of FHSS, and FHSS is one of the two inherent features of CDMA (the other inherent feature is DSSS).

Respectfully Submitted,

Date: 8/14/2010

By: C. Earl Woolfork

EXHIBIT A

SPREAD SPECTRUM SYSTEMS

with

COMMERCIAL APPLICATIONS

THIRD EDITION

ROBERT C. DIXON

very significant property of TDMA is that users can operate together in a TDMA mode with no near-far problem at all.

Transmission of single-user-per-carrier TDMA is also a practical technique, and is the basis for "digital cellular" systems. In such systems, much of the overhead required is not taken up by actual transmission of data, however. Instead, to prevent signals that are transmitted by multiple users at varying distances from a receiver, from arriving at the same time, a guard space is added to each time slot.

In small cells, guard time may be insignificant, but in large cells, guard time may actually take up more time than is allotted for data transmission. Since radio signals propagate at approximately six microseconds per mile, any distance uncertainty in the position of a transmitter with respect to a receiver must appear in the guard time allowance in every time slot. Time slot size and guard time are both very important, as larger time slots mean fewer guard times, but processing delay may be longer.

With the 197.9 users we previously postulated, let us consider an example:

- Suppose each 8-Kbps user has 100 time slots per second. He must transmit his data in 80-bit increments, with eight bits of overhead.
- There are 19,790 time slots per second available, each with period 50.5305 microseconds.
- Data is transmitted in 88-bit chunks, at a rate of 1.741520 megabits per second. Thus 4.6 microseconds per time slot is left for guard time, and this in turn allows approximately a 0.75-mile range uncertainty.
- If longer time slots are used, with fewer per user, longer guard time and therefore larger cells could be accommodated.

This example is intended merely to show the relationships involved in TDMA systems (single user per carrier).

Code-Division Multiple Access

CDMA, or code-division multiple access systems, use codes to separate one signal from another (as we have previously discussed in Chapter 1). Either direct sequence or frequency hopping systems can employ CDMA, so we will compare both methods to FDMA and TDMA approaches.

CDMA systems are dependent on the design of codes that are "orthogonal" to one another, at least within the set of codes employed in a network. Orthogonality in this context means simply that all of the codes used must have low enough mutual cross-correlation that they do not significantly interfere with one another over the dynamic range of the signals presented to any receiver in a CDMA network. This is the purpose of the Gold codes, Kasami codes, and Bent codes discussed in Chapter 3. Unfortunately, there is no known set of codes that is completely orthogonal when used in the

ULE T

conditions*. That exist in a
access system with a large n
under these conditions is tha
way as additive white Gaussi
to add no more interference
power level. If the codes use
same time, then the limit on
because a receiver will work
signals does not exceed the
jamming margin. Therefore,
if all users' signals are equal

Jamming margin in a dire

RF band
data r

In a 1-MHz bandwidth, wil
mately

$10 \log \frac{1 \times 1}{8 \text{ Kb}}$

and the maximum number
ceives, each of which meets
126.*

Improvements might be
processing gain) reducing re
losses.

In frequency hopping, the
receiver's jamming margin,
frequencies interfered with.

In the ISM bands, at 1
900-MHz band, and 75 freq
to 20% of these frequencies
number of users possible we

50/5 = 1

*More than 100-dB dynamic ran
varying signal blockage, etc.
**This is an extremely optimistic es
error correction, and this is onto n
1/2 or 4 Kbps). With the same id
TDMA users would go up. 05-dB
estimates CDMA would look mad
Corned by using variation of spread

If we compare time division CDMA to power-control CDMA in multiuser networks (for example, a network with a single base station and many randomly distributed users scattered around it), it is easy to see that:

- The time division base station requires only one transmitter and one receiver to service all its associated users. (This includes any signal processing that is to be done.) The power-control base station, on the other hand, requires a separate transmit channel* and a separate receive channel for every user. This means that a power-control system with 32 users would require 32 transmit channels and 32 receive channels, while the time division system requires only one.

If more users are accommodated, by either reducing data rates or by narrowing a base station's coverage, then the number of transmitters and receivers simply goes up by the same amount as the increase in users. Increasing processing gain and thereby jamming margin/number of users, by reducing data rate would allow

Data Rate	Jamming Margin	Number of Users
8 Kbps	15.9 dB	39.25
4 Kbps	18.9 dB	78.5
2 Kbps	21.9 dB	157

From this we see the value of reducing the data rate in a spread spectrum system. We note, however, that reducing the data rate in nonspread-spectrum systems can produce similar results. (We will see an example of this in the succeeding pages.)

Important Note:

It is of no use whatsoever to consider the number of users possible in a spread spectrum system to be 50, 100, or any other number unless the codes employed (remember that we are discussing *code division multiple access*) are capable of providing sufficiently low cross-correlation between every user and every other user.

Frequency Hopping and CDMA

For some reason which is not obvious, it is often assumed that CDMA and direct sequence methods are synonymous. Our discussion of CDMA in the previous section certainly applies to direct sequence (notice that the words "direct sequence" were never used) but also may be applied to frequency hopping.

*A single power amplifier and a single receiver front-end/down converter can be used, but separate processing, modulation and demodulation is still needed for every user because each uses a separate code to differentiate itself from other user signals.

If one has two or more
bandwidth, but using different
called code division multiple
no matter that some mistaken
only direct sequence with per
How many users are prac
users is a function of the re
that we have a 1.25-MHz RF
rate 1/2 coding (19.2-K sym
correctable. We will also use
1/2. (This is MSK modulation

Bandwidth per channel

Number of channels avail

Jamming MARGIN (throu

S/N

Jamming Margin (other u

(This assumes five channels f
jammed channel produces a
In military systems, it is
respect to every other user.
many channels available sim
ting each user with respect
sequentially uses the same
randomly interfere with one
support up to 832 users in e
Commercial users are n
hopped channels or to emp
that offsetting of code seque
to every channel in the ban
approach is effectively the sa
channel being used, interfe
greatly increased.

some advantages that other forms of direct sequence modulation cannot match. We hasten to state that there are many forms of MSK modulation, each with different spectrum and characteristics. Offset QPSK is, in fact, one form of MSK modulation. We will further discuss these forms and compare their characteristics in detail in Chapter 4.

2.2 FREQUENCY HOPPING*

"Frequency hopping" modulation is more accurately termed "multiple-frequency, code-selected, frequency shift keying." It is nothing more than FSK (frequency shift keying) except that the set of frequency choices is greatly expanded. Simple FSK most often uses only two frequencies; for example f_1 is sent to signify a "mark," f_2 to signify a "space." Frequency hoppers, on the other hand, often have thousands of frequencies available. One real system[1] has 2^{20} discrete frequency choices, randomly chosen, each selected on the basis of a code in combination with the information transmitted. The number of frequency choices and the rate of hopping from frequency to frequency in any frequency hopper is governed by the requirements placed on it for a particular use.

Characteristics of Frequency Hopping Signals

A frequency hopping system or "frequency hopper" consists basically of a code generator and a frequency synthesizer capable of responding to the coded output from the code generator. A great deal of effort has been expended in developing rapid-response frequency synthesizers for spread spectrum systems.

Ideally, the instantaneous frequency hopper output is a single frequency. Practically, however, the system user must be satisfied with an output spectrum which is a composite of the desired frequencies, sidebands generated by hopping, and spurious frequencies generated as by-products.

Figure 2.12 is a simplified block diagram of a frequency hopping transmission system. The frequency spectrum of this frequency hopper is shown in Figure 2.13.

Over a period of time, the ideal frequency hopping spectrum would be perfectly rectangular, with transmissions distributed evenly in every available frequency channel. The transmitter should also be designed to transmit, to a degree as close as practical, the same amount of power in every channel.

The received frequency hopping signal is mixed with a locally generated replica, which is offset a fixed amount such that $(f_1, f_2, \ldots, f_n) \times (f_1 + f_{IF}, f_2 + f_{IF}, \ldots, f_n + f_{IF})$ produces a constant difference frequency f_{IF} when transmitter and receiver code sequences are in synchronism.

*See the Bibliography Sections 1, 7, and 8.